Claims

1. Method for the manufacture of hollow body elements (200) such as nut elements for attachment to components normally consisting of sheet metal (280), in particular for the manufacture of hollow body elements, having an at least substantially square or rectangular outline (202) by cutting individual elements to length from a section present in form of a profile bar (1) or of a coil after prior piercing of apertures (204) into the section, optionally with subsequent formation of a thread cylinder (206) using a progressive tool (10) having a plurality of working stations (A, B, C, D) in each of which respective operations are carried out,

characterized by the following steps:

a) in a first step, starting from a section (1) rectangular in cross-section, an upsetting process is carried out which leads to a cylindrical recess (208) at a first broad side (2) of the section and to a hollow cylindrical projection (210) at a second broad side (3) of the section opposite to the first broad side (2), the projection being surrounded by a ring-shape recess (202),

b) in a second step, a web (218) remaining between the base (214) of the cylindrical recess and the base (216) of the hollow cylindrical projection (210) is pierced or punched out to form a through-going aperture (204),

c) in a third step, which can optionally be combined with the second step b), the hollow cylindrical projection (210) is flattened or crushed at its free end for the formation of a piercing section

(222) and undercut at the outer side, whereafter the hollow body element (200) is separated from the section and optionally provided with thread (206).

2. Method in accordance with claim 1, characterized in that, during the upsetting operation of step a), the diameter of the cylindrical recess (208) and the inner diameter of the hollow cylindrical projection (210) are made at least substantially the same.

3. Method in accordance with claim 1 or claim 2, characterized in that, during the upsetting process of step a) or during the piercing process of step b) or during the flattening process of step c), the opening of the cylindrical recess (208) is executed at the first broad side of the section with a rounded or chamfered run-in edge (230).

4. Method in accordance with one of the preceding claims, characterized in that, during the upsetting process of step a) or during the piercing process of step b) or during the flattening process of step c), the opening of the hollow cylindrical projection (210) is provided at its free end with a rounded or chamfered run-out edge (234).

5. Method in accordance with one of the preceding claims, characterized in that, during the piercing of the web in accordance with step b), an aperture (204) is produced with a diameter which at least substantially corre-

sponds to the diameter of the cylindrical recess (208) and to the inner diameter of the hollow cylindrical projection (210).

6. Method in accordance with one of the preceding claims, characterized in that, during the upsetting process of the first step a), the free end of the hollow cylindrical projection (210) is provided at the outside with a chamfer (236).

7. Method in accordance with one of the preceding claims, characterized in that, during the upsetting process of the first step a), the recess (212) is provided with a ring-like base region (238) which stands at least approximately in a plane parallel to the first and second broad sides (2, 3), is provided at the radially inner side with an at least substantially rounded transition (240) into the outer side of the hollow cylindrical projection (210) and merges at the radially outer side into a conical surface (242).

8. Method in accordance with claim 7, characterized in that the conical surface (242) of the ring recess (212) has an included cone angle in the range between 60 and 120°, preferably of approximately 90°.

9. Method in accordance with one of the preceding claims, characterized in that

the transition from the ring-shaped region (240) of the ring recess into the conical surface (242) is rounded.

10. Method in accordance with one of the claims 7 to 9, characterized in that the run-out of the conical surface (242) of the ring recess into the second broad side (3) of the section is rounded.

11. Method in accordance with one of the preceding claims, characterized in that, during the manufacture of the undercut (244), this is formed by a cylindrical part of the hollow cylindrical projection (210) which merges approximately at the level of the second broad side (3) of the section into a region (222) of the hollow cylindrical projection which is thickened on carrying out the step c) and which at least substantially projects beyond the second broad side of the section.

12. Method in accordance with claim 11, characterized in that the thickened region (222) of the hollow cylindrical projection is made at least substantially conical and diverges away from the first and second broad side (2, 3).

13. Method in accordance with claim 12, characterized in that the cone angle of the thickened region (222) of the hollow cylindrical projection lies in the range from 30° and 70°, preferably at approximately 50°.

14. Method in accordance with one of the preceding claims, characterized in that, after the flattening process, the hollow cylindrical projection (210) ends at its free end outwardly in a piercing edge (250) which is as sharp edged as possible.

15. Method in accordance with one of the preceding claims, characterized in that the ring recess (212) is executed with an outer diameter which is only made somewhat smaller than the smallest transverse dimension of the hollow body element (200) which is rectangular in plan view, whereby the ring recess with the second broad side of the section forms webs (284, 286) which remain at the narrowest points in the plane of the second broad side with a width in the range from 0.25 to 1 mm, preferably at approximately 0.5 mm.

16. Method in accordance with one of the preceding claims, characterized in that, during the upsetting process in accordance with step a) a ring-like raised feature (260) is provided at the first broad side(2) of the section around the cylindrical recess (208).

17. Method in accordance with one of the preceding claims, characterized in that, during the upsetting process in accordance with step a) features (272) providing security against rotation are formed outwardly at the hollow

cylindrical projection (210) and/or inwardly in the region of the ring recess (212) around the hollow cylindrical projection (210).

18. Method in accordance with claim 17, characterized in that the features providing security against rotation are formed by ribs (272) and/or by grooves at the radially outer side of the hollow cylindrical projection (210).

19. Method in accordance with claim 17 or 18, characterized in that the features providing security against rotation are formed by ribs (272) which extend in the axial direction and bridge the undercut (244) of the hollow cylindrical projection (210).

20. Method in accordance with claim 19, characterized in that the ribs (272) providing security against rotation have a radial width which corresponds at least substantially to between 40 % and 90 % of the maximum radial depth of the undercut (244).

21. Method in accordance with claim 17, characterized in that the features providing security against rotation are formed in the step a) by radially extending ribs which bridge the ring recess.

22. Method in accordance with claim 17 or claim 21, characterized in that

the features providing security against rotation are made in the form of obliquely positioned ribs providing security against rotation which extend in the radial direction over the ring recess and in the axial direction along the hollow cylindrical projection, i.e. along the later undercut of the piercing section.

23. Method in accordance with claim 17 or claim 21, characterized in that the features providing security against rotation are made in the form of ribs providing security against rotation which extend in the radial direction across the ring recess and in the axial direction along the hollow cylindrical projection, i.e. along the later undercut of the piercing section.

24. Method in accordance with claim 17, characterized in that features providing security against rotation are made in the form of recesses, and indeed in step a), step b) or step c), or in that recesses are formed which are arranged in the inclined surface of the ring recess.

25. Method in accordance with claim 1, characterized in that, in deviation from claim 1, in step a), likewise starting from the section 1 rectangular in cross-section, a forming process is carried out in which optionally no cylindrical recess (208) is provided at the first broad side (2) of the section (1), but which leads at the second broad side (3) of the section (1) to a recess (212') at the second broad side (3)

of the section which is preferably polygonal in plan view, in particular square, which surrounds the hollow cylindrical projection (210) which is formed partly from the material displaced during the formation of the recess (212) and partly from the material displaced during the formation of the hollow space of the hollow cylindrical projection (210), with the recess (212') being provided with a ring surface or surfaces set obliquely to the central longitudinal axis of the hollow body element and in the second step b), the material between the first broad side (2) of the section (1) and the base (216) of the hollow cylindrical projection (210) is pierced or punched out for the formation of a through-going aperture (204).

26. Hollow body element for attachment to a component (280) normally consisting of sheet metal having an in particular at least substantially square or rectangular outline with a first broad side (2) and a second broad side (3), with a piercing section (222) which projects beyond the second broad side (3) and has an undercut (244) and is surrounded by a ring recess (212) in the second broad side and also with an aperture (204) which extends from the first broad side (2) through the piercing section (222), with the aperture optionally having a thread cylinder (206),
characterized in that
features (272) providing security against rotation are formed outwardly at the hollow cylindrical projection (210) and/or inwardly in the region of the ring recess (212) around the hollow cylindrical projection (210).

27. Hollow body element in accordance with claim 26,
characterized in that

the features providing security against rotation are formed by ribs (272) and/or grooves at the radially outer side of the hollow cylindrical projection (210).

28. Hollow body element in accordance with claim 26 or claim 27, characterized in that
the features providing security against rotation are formed by ribs (272) which extend in the axial direction and bridge the undercut (244) of the hollow cylindrical projection (210).

29. Hollow body element in accordance with claim 28, characterized in that
the ribs (272) providing security against rotation have a radial width which lies at least substantially in the region between 40 % and 90 % of the maximal radial depth of the undercut (244).

30. Hollow body element in accordance with claim 26, characterized in that
the features providing security against rotation are provided in the form of radially extending ribs which bridge the ring recess.

31. Hollow body element in accordance with claim 26 or claim 30, characterized in that
the features providing security against rotation are provided in the form of obliquely set ribs providing security against rotation which extend in the radial direction across the ring recess and in the axial direction along the undercut of the piercing section.

32. Hollow body element in accordance with claim 26 or claim 30, characterized in that
the features providing security against rotation are provided in the form of ribs providing security against rotation which extend in the radial direction across the ring recess and in the axial direction along the undercut of the piercing section.

33. Hollow body element in accordance with claim 26, characterized in that
the features providing security against rotation are provided in the form of recesses which are arranged in the obliquely set surface of the ring recess.

34. Hollow body element in accordance with one of the preceding claims 26 to 33,
characterized in that
the second broad side (3) lies in a plane radially outside of the ring recess, i.e. apart from any rounded features or chamfers at the transitions into the side flanks of the hollow body element and thus has no bars, grooves or undercuts in the region outside of the ring recess (212).

35. Hollow body element in accordance with one of the claims 26 to 34, characterized in that
the opening of the cylindrical recess (208) at the first broad side of the section is executed with a rounded or chamfered run-in edge (230).

36. Hollow body element in accordance with one of the claims 26 to 35, characterized in that
the opening of the hollow cylindrical projection (210) is provided at its free end with a rounded or chamfered run-out edge (234).

37. Hollow body element in accordance with one of the preceding claims 26 to 36,
characterized in that
the ring recess (212) is provided with a ring-like base region (238) which stands at least approximately in a plane parallel to the first and second broad side (2, 3), and merges at the radially inner side with an at least substantially rounded transition (240) into the outer side of the hollow cylindrical projection and at the radially outer side into a conical surface (242).

38. Hollow body element in accordance with one of the preceding claims 26 to 37,
characterized in that
the ring recess (212) is executed with an external diameter which is only somewhat smaller than the smallest transverse dimension of the hollow body element (200) which is rectangular in plan view, whereby the ring recess forms webs with the second broad side of the section which remain at the narrowest points in the plane of the second broad side in the range from 0.25 to 1 mm, preferably of approximately 0.5 mm.

39. Hollow body element for attachment to a component (280) normally consisting of sheet metal having an in particular at least substantially

square or rectangular outline with a first broad side(2) and a second broad side (3) with a piercing section (222) which projects beyond the second broad side (3) and has an undercut (244) and is surrounded by a ring recess (212') in the second broad side and also with an aperture (204) which extends from the first broad side (2) through the piercing section (222), with the aperture optionally having a thread cylinder (206),
characterized in that
the ring recess (212') is polygonal and in particular square in plan view and in that the ring recess (212') is provided with a surface or plurality of surfaces set obliquely to the central longitudinal axis of the hollow body element.

40. Component assembly comprising a hollow body element (200) in accordance with one of the preceding claims 26 to 39, which is attached to a component, for example to a sheet metal part (280), with the material of the component or of the sheet metal part (280) contacting the surface of the ring recess (212) of the hollow body element at the surface of features (272) providing security against rotation and also at the surface of the undercut (244) of the piercing section (222) of the hollow body element, and with a ring recess (282) being present in the material of the component or of the sheet metal part (280) around the piercing section.

41. Component assembly in accordance with claim 40,
characterized in that
the axial depth of the ring groove (282) in the sheet metal part is selected in dependence on the length of the piercing section and the

thickness of the sheet metal part (280) so that the end face (224) of the piercing section (222) does not project or only fractionally projects beyond the side of the sheet metal part which is remote from the body of the hollow body element (200) and is present in the region beneath the second broad side (3) of the hollow body element around the ring recess (212) of the hollow body element.

42. Component assembly in accordance with claim 40 or 41, characterized in that the second broad side (3) of the hollow body element (200) is at least substantially not pressed into the sheet metal material or is at most only trivially pressed into the sheet metal material in the region around the ring recess (212) of the hollow body element (200).

43. Progressive tool for the manufacture of hollow body elements (200) such as nut elements for attachment to components normally consisting of sheet metal (280), in particular for the manufacture of hollow body elements having an at least substantially square or rectangular outline (202) by cutting individual elements to length from a section (1) present in the form of a profile bar or a coil after prior piercing of apertures (204) into the section, optionally with subsequent formation of a thread cylinder (206) using a progressive tool with a plurality of working stations (A, B, C, D), wherein in each case two operations are simultaneously carried out for each stroke of the progressive tool in each working station for the section or for a plurality of sections arranged alongside one another,
characterized in that
an upsetting process is carried out in a first working station (A), a

piercing process is carried out in a second working station (B), a flattening process is carried out in a third working station (C) and the separation of in each case two hollow body elements from the section or from each section is carried out in a fourth working station (D) by means of the cut-off punch.